CLAIMS:

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13. A method of operating a fuel cell system comprising a plurality of fuel cells, each fuel cell comprising an inlet for fuel, an anode having a catalyst associated therewith for producing cations from fuel, a fuel manifold connected between the inlet and the anode for distributing fuel to the anode, an oxidant inlet means for supplying oxidant, a cathode having a catalyst associated therewith and connected to the oxidant inlet means for producing anions from the oxidant, said anions reacting with said cations to form water on said cathode and an ion exchange membrane disposed between the anode and the cathode, for facilitating migration of cations from the anode to the cathode, while isolating the fuel and oxidant from one another, the method comprising

(a) supplying oxidant and fuel to the oxidant inlet means an the fuel inlet of the fuel cells for reaction to generate electrical power and heat;

(b) providing a catalytic reactor for promoting reaction of the fuel and the oxidant, supplying the fuel to the catalytic reactor and supplying the oxidant to the catalytic reactor in an amount less than the stoichiometric amount required for the combustion of the fuel to ensure complete consumption of the oxidant, thereby generating a flow of heated and humidified fuel; and

(c) supplying the heated and humidified fuel to the fuel inlets of the fuel cells, for reaction with the oxidant to generate electricity and heat.

14. A method as claimed in claim 13, which comprises, for initial start-up below a preset temperature, initially supplying fuel and oxidant only to the catalytic reactor to generate a flow of heated and humidified fuel, and passing the heated and humidified fuel through the fuel cells to preheat the fuel cells, and commencing supply of oxidant to the fuel cells, once the fuel cells reach a desired temperature.

15. A method as claimed in claim 14, which includes, after start-up and after the cell has reached the desired temperature, supplying a sufficient quantity of the oxidant and the fuel to the catalytic reactor, to maintain the fuel supplied to the fuel cell system at a desired humidity level.

16. A method as claimed in claim 15, which includes: supplying air as the oxidant; providing the fuel cell system as an air-breathing system including vertical channels for flow of air as the oxidant; and providing only a portion of the air required as the oxidant through the catalytic reactor, with additional air flowing directly through the channels of the fuel cell system.

17. (New) A method as claimed in claim 13, which includes:

(a) providing a second catalytic reactor for promoting reaction of the fuel in the oxidant, supplying the fuel to the catalytic reactor and supplying the oxygen to the catalytic reactor in an amount greater than the stoichiometric amount required for the combustion of the fuel to ensure complete consumption of the fuel and thereby to generate a flow of heated and humidified oxidant; and

(b) supplying the heated and humidified oxidant to the fuel cell for reaction with the heated and humidified fuel.

18. (New) A method as claimed in claim 17, wherein each of the first and second catalytic reactors is generally tubular.

19. (New) A method as claimed in claim 17, which includes supply lines for fuel and oxidant connected to the first and second catalytic reactors, and check valves in the supply lines for preventing back flow of oxidant and fuel.

20. (New) A method as claimed in claim 19, which includes flash arresters in the supply lines for the fuel connected to the first and second catalytic reactors.

21. (New) A method as claimed in claim 19 or 20, which includes a pump for delivering air as an oxidant to the first and second catalytic reactors.

22. (New) A method of operating a fuel cell system comprising a plurality of fuel cells, each fuel cell comprising an inlet for fuel, an anode having a catalyst associated therewith for producing cations from fuel, a fuel manifold connected between the inlet and the anode for distributing fuel to the anode, an

oxidant inlet means for supplying oxidant, a cathode having a catalyst associated therewith and connected to the oxidant inlet means for producing anions from the oxidant, said anions reacting with said cations to form water on said cathode and an ion exchange membrane disposed between the anode and the cathode, for facilitating migration of cations from the anode to the cathode, while isolating the fuel and oxidant from one another, the method comprising:

(a) supplying oxidant and fuel to the fuel cell for reaction to generate electrical power and heat;

(b) providing a catalytic reactor for promoting reaction of the fuel and the oxidant, supplying the fuel to the catalytic reactor and supplying the oxidant to the catalytic reactor in an amount greater than the stoichiometic amount required for the combustion of the fuel to ensure complete consumption of the fuel, and thereby to generate a flow of heated and humidified oxidant; and

(c) supplying the heated and humidified oxidant to the fuel cell system, for reaction with the oxidant to generate electricity and heat.

23. (New) A method as claimed in claim 22, for which it comprises, for initial start-up below a preset temperature, initially supplying fuel and oxidant only to the catalytic reactor to generate a flow of heated and humidified oxidant, and passing the heated and humidified oxidant through the fuel cells to pre-heat the fuel cells, and commencing supply of fuel to the fuel cells, once the fuel cells reach a desired temperature.

24. (New) A method as claimed in claim 22 or 23, which includes providing the catalytic reactor as a tubular reactor.

25. (New) A method as claimed in claim 22 or 23, which includes:

supplying air as the oxidant;

providing the fuel cell system as an air-breathing system including vertical channels for flow of air as the oxidant;

and providing only a portion of the air required as the oxidant through the catalytic reactor, with additional air flowing directly through the channels of the fuel cell system.